The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte EARL R. AULT

MAILED
MAR 10 2005
U.S. PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS
AND INTERFERENCES

Appeal No. 2005-0616
Application No. 09/661,653

ON BRIEF

Before COHEN, NASE, and BAHR, Administrative Patent Judges.

NASE, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1, 3 to 5 and 9, which are all of the claims pending in this application.

We REVERSE.

BACKGROUND

The appellant's invention relates to a high power laser with a trivalent titanium liquid host (specification, p. 1). A copy of the claims under appeal is set forth in the appendix to the appellant's brief.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Kocher et al. (Kocher)	3,663,891	May 16, 1972
Chun	4,654,855	Mar. 31, 1987
Scheps	5,307,358	Apr. 26, 1994

Claims 1, 3 to 5 and 9 stand rejected under 35 U.S.C. § 103 as being unpatentable over Kocher in view of Chun and Scheps.

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellant regarding the above-noted rejection, we make reference to the answer (mailed March 17, 2004) for the examiner's complete reasoning in support of the rejection, and to the brief (filed February 19, 2004) and reply brief (filed March 30, 2004) for the appellant's arguments thereagainst.

OPINION

In reaching our decision in this appeal, we have given careful consideration to the appellant's specification and claims, to the applied prior art references, and to the respective positions articulated by the appellant and the examiner. Upon evaluation of all the evidence before us, it is our conclusion that the evidence adduced by the examiner is insufficient to establish a prima facie case of obviousness with respect to the claims under appeal. Accordingly, we will not sustain the examiner's rejection of claims 1, 3 to 5 and 9 under 35 U.S.C. § 103. Our reasoning for this determination follows.

In rejecting claims under 35 U.S.C. § 103, the examiner bears the initial burden of presenting a prima facie case of obviousness. See In re Rijckaert, 9 F.3d 1531, 1532, 28 USPQ2d 1955, 1956 (Fed. Cir. 1993). A prima facie case of obviousness is established by presenting evidence that would have led one of ordinary skill in the art to combine the relevant teachings of the references to arrive at the claimed invention. See In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988) and In re Lintner, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

A critical step in analyzing the patentability of claims pursuant to 35 U.S.C. § 103 is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. See In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher." Id. (quoting W.L. Gore & Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 313 (Fed. Cir. 1983)).

Most if not all inventions arise from a combination of old elements. See In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457 (Fed. Cir. 1998). Thus, every element of a claimed invention may often be found in the prior art. See id. However, identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention. See id. Rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the appellant. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); In re Gordon, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984).

The motivation, suggestion or teaching may come explicitly from statements in the prior art, the knowledge of one of ordinary skill in the art, or, in some cases the nature of the problem to be solved. See Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617. In addition, the teaching, motivation or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references. See WMS Gaming, Inc. v. International Game Tech., 184 F.3d 1339, 1355, 51 USPQ2d 1385, 1397 (Fed. Cir. 1999). The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981) (and cases cited therein). Whether the examiner relies on an express or an implicit showing, the examiner must provide particular findings related thereto. See Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617. Broad conclusory statements standing alone are not "evidence." Id. When an examiner relies on general knowledge to negate patentability, that knowledge must be articulated and placed on the record. See In re Lee, 277 F.3d 1338, 1342-45, 61 USPQ2d 1430, 1433-35 (Fed. Cir. 2002).

The claimed subject matter

Claims 1 and 9, the independent claims on appeal, read as follows:

1. A laser, comprising:
a laser cavity having a first lasing chamber,
a second lasing chamber,
trivalent titanium ions dissolved in a liquid host within said first lasing chamber,
trivalent titanium ions dissolved in a liquid host within said second lasing chamber,
a first semiconductor pumping device operatively connected to said first lasing chamber for optically exciting said trivalent titanium ions dissolved in said liquid host within said first lasing chamber, said first semiconductor pumping device comprising at least one semiconductor diode for optically exciting said trivalent titanium ions dissolved in said liquid host within said first lasing chamber,
a second semiconductor pumping device operatively connected to said second lasing chamber for optically exciting said trivalent titanium ions dissolved in said liquid host within said second lasing chamber, said second semiconductor pumping device comprising at least one semiconductor diode for opdcally exciting said trivalent titanium ions dissolved in said liquid host within said lasing second chamber,
a closed loop circulation system for circulating said trivalent titanium ions dissolved in a liquid host through said first lasing chamber in a first linear direction into said closed loop circulation system and into said second lasing chamber and through said second lasing chamber in a second linear direcdon into said closed loop circulation system and back into said first lasing chamber, said second linear direction being opposite to said first linear direction, said closed loop circulation system comprising
a first portion for circulating said trivalent titanium ions dissolved in a liquid host into and out of said first lasing chamber in said first linear direction and
a second portion for circulating said trivalent titanium ions dissolved in a liquid host into and out of said second lasing chamber in said second direction that is opposite to said first linear direction.

9. A laser system, comprising:
an optical cavity having
a first lasing chamber and

a second lasing chamber,

a lasing liquid containing trivalent titanium ions dissolved in a liquid host within said first lasing chamber and said second lasing chamber,

a first semiconductor pumping device operatively connected to said first lasing chamber for optically exciting said trivalent titanium ions dissolved in a liquid host within said first lasing chamber, said first semiconductor pumping device comprising at least one semiconductor diode for optically exciting said trivalent titanium ions in the 800 to 900 nm region,

a second semiconductor pumping device operatively connected to said second lasing chamber for optically exciting said trivalent titanium ions dissolved in a liquid host within said second lasing chamber, said second semiconductor pumping device comprising at least one semiconductor diode for optically exciting said trivalent titanium ions in the 800 to 900 nm region,

a closed loop circulation system for circulating said trivalent titanium ions dissolved in a liquid host, said closed loop circulation system comprising

a first portion for circulating said lasing liquid containing trivalent titanium ions dissolved in a liquid host into and out of said first lasing chamber in a first direction, and

a second-portion for circulating said lasing liquid containing trivalent titanium ions dissolved in a liquid host into and out of said second lasing chamber in a second direction that is opposite to said first direction, said closed loop circulation system including a pump and a heat exchanger.

The teachings of the applied prior art

Kocher

Kocher's invention relates to lasers and in particular to cells for lasers which utilize a flowing liquid as the active material. Kocher teaches (column 1, lines 6-11) that:

> Solids, gases and liquids have been used as active materials in lasers. Lasing is initiated by raising the energy levels of the atoms in the active material from the level which they normally occupy to a higher energy level or excited

state. This process of excitation is generally accomplished in a liquid laser by a high intensity light source.

Figure 1 shows a schematic representation of a circulating liquid laser. A circulating liquid laser is one in which the liquid active material continuously flows through a closed system. The liquid active material is an inorganic solution of a compound containing an active ion, an inorganic solvent and a Lewis acid. Although many such solutions may be employed, in the preferred form of Kocher's invention the active ion is tri-valent neodymium, the inorganic solvent is phosphorus oxychloride and the Lewis acid is zirconium tetrachloride.

The circulating liquid laser consists of a resonant cavity 10 having a longitudinal axis 11 and containing a cell 12 and mirrors 14 and 16 located adjacent the opposite end of laser cell 12. Mirrors 14 and 16 may either be mounted externally to cell 12, as shown in Figure 1, or may take the form of reflective coatings placed directly on the end faces 18 and 20 of the cell. One of the mirrors, for example, mirror 14, is totally reflective, i.e., it reflects substantially all of the light impinging upon it. The other mirror, mirror 16, is only partially reflective in that it reflects only a portion of the light impinging upon it while permitting the remainder of the light to be transmitted there through as the output beam of the laser.

Excitation means in the form of light source 22, positioned in close proximity to cell 12 provides a source of excitation energy to the active material flowing through the cell. The light source may take the form of a high pressure Xenon filled lamp which is controlled by an external circuit (not shown). The walls of cell 12 are constructed of quartz or other material which transmits radiation with negligible attenuation at the frequency required to excite the active material.

The laser further comprises a centrifugal pump 24 for circulating the liquid active material through the laser and heat exchanger 26 which cools the liquid after it flows out of cell 12. Lines 28, 30 and 32 interconnect pump 24, heat exchanger 26 and cell 12.

Chun

Chun's invention pertains to pulsed gas lasers. More particularly, Chun's invention pertains to means for circulating the gas within a pulsed gas laser. Chun's invention uses "acoustic obstacles" to circulate the gas in the pulse discharge gas laser. The acoustic diodes consist of passive mechanical diodes located within the gas filled chamber of the laser, which obstacles exhibit an asymmetrical resistance to the passage of the compression wave generated by the discharge of electrical current through the gas. Because the obstacles exhibit less resistance to the passage of the compression wave in one direction as compared to the opposite direction, the obstacles

cause a net flow of gas to occur in the direction of lesser resistance. As a consequence, the acoustic diodes interact with the compression waves to circulate the gas through the interior of the laser.

Figure 1 depicts a cross-sectional view of the pulse discharge laser. A gas 1 is contained within the volume enclosed by interior wall 2 and exterior wall 3 of the laser. The portions of the gas located within the active regions 4 of the laser are excited by an electrical current discharged in a pulsed manner between pairs of electrodes 5. Although two discharge regions are depicted in the preferred embodiment, a single region or more than two regions could instead be used. The discharge of electricity also generates a pair of compression waves in the gas which propagate in opposite directions away from the active regions 4 and which waves each have a width approximately equal to the width of the discharge electrodes 5, i.e., the width of the active regions 4. Although the gas mixture in the preferred embodiment of the Xe Cl laser comprises 2% xenon (Xe) and 0.2% hydrogen chloride (HCl) in a diluent of neon at 4 atmospheres, other combinations of gases, diluents and pressures may be used in the invention. X-ray gun 14 preionizes the gas prior to the discharge of electricity through active region 4.

As shown in Figure 1, the gas 1 circulates through the pulse discharge laser in the direction depicted by arrows 6 so as to flow successively through heat exchangers 7 and the active regions 4 of the pulse discharge laser. In operation, the gas within active regions 4 is replaced after each discharge of current by gas coming from, and which has been cooled by, heat exchangers 7.

A number of acoustic obstacles 8, referred to by Chun as "acoustic diodes", are located upstream of regions 4 as depicted in Figure 1 within the volume of gas contained by walls 2 and 3. The obstacles 8 are a series of columns running from wall 3 to wall 2 which have cupped-shaped cross sections as depicted in Figure 3. Also as depicted in Figure 3, the depth 9 of the cupped portion of the cross-section in the preferred embodiment is approximately the same as the width 10 of the discharge electrode 5. As a consequence, the depth of the cup is approximately the same as the width of the compression wave that is generated by the discharge of electricity between electrodes 5. This depth is optimum for the reflection of the incident waves. The faces 11 of obstacles 8 that are opposite the "cups" have a rounded or more streamlined shape as contrasted to the cupped side of the obstacles. As a consequence of the selection of the depth of the cups and of the streamlined shape of the opposite side of the obstacles, the obstacles 8 interact with the compression wave in the gas that is generated by the discharge of electricity through the gas so as to cause a net flow of

gas through the obstacles in the direction indicated by arrows 12 in Figure 3. In order to cause the gas to circulate through the heat exchanger and the active region, as depicted in Figure 1, the obstacles 8 all are oriented so that the openings of the cups face downstream to the flow of the gas.

Scheps

Scheps' invention relates to tunable lasers which produce laser emission at one or more wavelengths over a preselected wavelength range. Tunable lasers are lasers which have the capability of emitting one or more wavelengths over a broad range of wavelengths. These lasers are continuously tunable over a preselected range of wavelengths and differ from non-tunable lasers which emit at certain fixed, discrete wavelengths.

A first embodiment of a tunable laser 10 in which the gain element is used as a tuning element is illustrated in Figure 2. The tunable laser 10 has its laser gain element 11 pumped by an argon ion laser 12. The laser gain element is an exemplary Ti^{3}+-activated sapphire host crystal to produce a laser beam or emission which can be tuned within the wavelength range of about 700 nm to 850 nm.

The tunable laser 10 includes a laser gain element 11 disposed in a resonator 15 defined by optically aligned end reflective element or mirror 17, concave fold reflective elements 13 and 13' and an output coupler reflective mirror 19. Mirror 17 is highly reflective while mirror 19 is partially transmissive to a laser wavelength of approximately 700 nm to 850 nm to provide the output coupling for the laser emission within the wavelength range of about 700 nm to 850 nm from tunable laser 10. It should, however, be noted that a different wavelength can be realized by utilizing different reflective coatings on optical elements 17, 13, 13' and 19, or by utilizing a laser gain element 11 which contains one or more different dopants and different associated optical elements. In addition, other gain media such as amorphous or glass-like materials, or liquid and gaseous materials, may be used as the laser gain element.

The examiner's rejection

In the rejection under appeal (answer, pp. 3-6) the examiner ascertained that Kocher does not teach (1) a second lasing chamber, (2) trivalent titanium ions dissolved in a liquid host, and (3) the pump source being a semiconductor diode. The examiner then concluded that it would have been obvious to one of ordinary skill in the art at the time of the invention to use (1) two chambers in Kocher, as taught by Chun, to provide continuous and efficient lasing activity, (2) the trivalent titanium ions dissolved in a liquid host in Kocher, as taught by Scheps, to produce a laser output with a specific

wavelength, and (3) a diode pump source in Kocher, as taught by Scheps, since choosing an optimum pumping device involves routine skill in the art.

The appellant's argument

The appellant argues (brief, pp. 7-13; reply brief, pp. 2-5) that absent the use of hindsight knowledge derived from the appellant's own disclosure[1] there is no reason for a person of ordinary skill in the art at the time the invention was made to have modified Kocher so as to arrive at the claimed subject matter. The appellants argue that the applied prior art does not suggest a laser having a closed loop circulation system for circulating trivalent titanium ions dissolved in a liquid host through a first lasing chamber in a first linear direction and through a second lasing chamber in a second linear direction opposite to the first linear direction.

Our view

After reviewing the teachings of the applied prior art, we fail to find any motivation, suggestion or teaching therein of the desirability of making the specific combination that was made by the appellant. That is, there is no rationale in the

[1] The use of such hindsight knowledge to support an obviousness rejection under 35 U.S.C. § 103 is, of course, impermissible. See, for example, W. L. Gore and Assocs., Inc. v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984).

applied prior art for a person of ordinary skill in the art at the time the invention was made to have modified Kocher so as to arrive at the claimed subject matter. While each element of the claimed invention may well be found in the applied prior art, such is insufficient to defeat patentability of the claimed invention absent some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the appellant. In this case, it is our view that there is none.

For the reasons set forth above, the decision of the examiner to reject claims 1 and 9, and claims 3 to 5 dependent thereon, under 35 U.S.C. § 103 is reversed.

CONCLUSION

To summarize, the decision of the examiner to reject claims 1, 3 to 5 and 9 under 35 U.S.C. § 103 is reversed.

REVERSED

IRWIN CHARLES COHEN
Administrative Patent Judge

JEFFREY V. NASE
Administrative Patent Judge

JENNIFER D. BAHR
Administrative Patent Judge

BOARD OF PATENT APPEALS AND INTERFERENCES

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